

# Investigación en tecnologías del aprendizaje y el conocimiento. Redacción, Diseño y Difusión

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## Resumen

Conocer los métodos y técnicas para la redacción nos ayuda a incrementar el conocimiento y a obtener conclusiones sobre la realidad, los fenómenos y los hechos que observamos; nos ayuda a analizar la relación que se establece entre los elementos que configuran una determinada situación educativa, y muchas veces, a tomar decisiones sobre cómo intervenir en dicha situación para mejorarla. Con todo, se espera que este artículo facilite la comprensión de la investigación científica educativa, su metodología de actuación y sus implicaciones para la práctica y la acción educativa

**Palabras clave:** Escritura, Proceso de aprendizaje, Metodologías de investigación, Recopilación de datos, Método científico.

**Title:** Research in learning and knowledge technologies Writing, Design and Diffusion.

## Abstract

Knowing the methods and techniques for writing helps us to increase knowledge and obtain conclusions about the reality, the phenomena and the facts that we observe; it helps us to analyze the relationship between the elements that make up a given educational situation and, often, to make decisions about how to intervene to improve it. However, it is expected that this article will facilitate the understanding of educational scientific research, its methodology of action and its implications for practice and educational action

**Keywords:** Writing, Learning Process, Research methodologies, Data collection, Scientific method.

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## METHODS AND TECHNIQUES FOR WRITING. THE SCIENTIFIC METHOD

Research in Education and in educational centers arises when we ask ourselves questions about how things work, how to behave and act from education, the effects of our educational practice or how we can innovate and improve the results of our Actions.

The research allows to obtain conclusions about the reality, the phenomena and the facts that we observe; Helps us to analyze the relationship between the elements that make up a particular educational situation, and often also to make decisions about how to intervene in that solution to improve it.

Therefore, the need to investigate arises when we want to know better how the process works, whether it is a subject, groups of subjects, a program, instrument, methodology, resource, context, etc., and we try to respond to multiple Questions we ask ourselves about how to improve our educational actions (Martínez, 2007).

In the educational field, this means, among other things, the improvement of educational, learning, teaching practices, dynamics of family interaction, classrooms, centers, academic performance, etc., Whether at local, regional, national or international level. An example of this could be studies on how to improve the teaching and / or learning processes of students with learning difficulties through the introduction of ICT and other variables under study (Díez, García, Robledo and Pacheco, 2009).

For all this, a detailed explanation of terms becomes necessary, on the one hand, for the multiplicity of meanings, and on the other, if we take into account that it constitutes, as a whole, the fundamental antecedent of the research process.

## The scientific method, conceptualization, characteristics and paradigms.

The scientific method is defined as a set of universal thoughts that form a systematic knowledge of reality (Ruiz, 2007).

The scientific method has its basis and position on mechanistic theory, where everything is considered as a machine, and to understand the whole we must break it down into small parts that allow us to study, analyze and understand their nexus, interdependence and connections between the whole and its parts.

The scientific method is the proposed procedure that is applied in the investigation to discover the effectiveness of the objective processes, to generalize and deepen the knowledge thus acquired, to get to verify its validity and effectiveness and to verify them (Martínez, 2007, Buendía, Colás and Hernández, 2003).

The scientific method is used in order to evolve in knowledge. In a rigorous sense, the scientific method is unique, both in its generality and in its particularity. It is self-sufficient, since it can not evolve in a knowledge gap, but rather requires some prior knowledge that can then be accommodated and readjusted, and which can subsequently be complemented by methods adapted to each theme, and of each area (Ruiz, 2007).

We can say that the scientific method is the means by which we try to answer the questions about the order of nature (Martínez, 2007). The questions we raise in an investigation are usually determined by our interests, and conditioned by the knowledge we already have. Of these two factors depends the "bias" or "validity-reliability" of the results.

The scientific method follows some characteristics aimed at obtaining a previous objective, for it begins with the Phase of Observation, where the subject makes contact with the phenomenon, in a second process, the Phase of the Approach of the hypothesis is established that is based in previous knowledge and in the data collected, and finally the Testing Phase, which depends on the degree of generality and replication of the hypothesis. The evidences they prove or disapprove are equally estimable.

In the process of scientific research various methods and techniques are used according to the particular science of origin and according to the specific characteristics of the object of study. There are, however, methods that can be considered general for all branches of science as they are procedures that are applied at different stages of the research process with greater or lesser emphasis, depending on when it is developed. These methods are analysis and synthesis, induction and deduction.

### **The Analytical Method**

The analytical method consists in the dissociation of a whole by decomposing it into its parts or elements to observe causes, nature and effects. The analysis is the observation of a particular fact. It is necessary to know the nature of the phenomenon and object that is studied to understand its essence. This method allows us to know more about the object of study, thus allowing us to explain, make analogies, better understand its behavior and establish new theories (Martínez, 2007). This method allows to decompose a whole in its parts to study intensively each of its elements, as well as the relations between themselves and with the whole.

### **The Synthetic Method**

The synthetic method is a process of reasoning that tends to reconstruct a whole, from the elements differentiated by the analysis.

The synthesis allows to reconstruct, to re-integrate the parts of the whole; Whenever it is allowed to advance in the knowledge, is not only the mere reconstruction but implies the understanding of the importance of the same, to know exhaustively each element and the logical relations of the totality. There is no synthesis without Engels sentence analysis, since the analysis provides the raw material to perform the synthesis (Fernández, 2007).

Analysis and synthesis are confronted at certain points in the process, but in others they complement each other, since both are articulated throughout the process of the evolution of knowledge.

### **Induction and deduction**

In order to reach a deeper and meaningful understanding of the origin, development and transformation of phenomena, it is fundamental to be able to propose objectives, hypotheses, laws and theories that allow to validate the facts with the concrete reality, taking into account the area of applied knowledge.

In this process of going from the particular to the general and vice versa we can highlight the presence of two methods: induction and deduction.

Induction refers to the movement of thought that goes from particular facts to general statements. This entails moving from the results obtained from observations or experiments to the hypothesis, laws and theories that cover not only the cases from which it was started, but also generalizes the results and replicates in the experiments (Martínez, 2007).

The deduction is the method that allows to be able to transform the affirmations of general character to particular facts. Deduction plays a very important role in science. Through it the principles discovered are applied to particular cases. The role of deduction in scientific research is twofold (Ruiz, 2007; Martínez, 2007):

- It allows to find unknown principles, from other known. A law or principle can be reduced to a more general one that includes it.
- It allows to describe unknown consequences, of known principles. Mathematics is the deductive science par excellence; Part of axioms and definitions.

## INTRODUCTION TO DESIGN AND GRAPHIC CREATION FOR DISSEMINATION OF RESEARCH

What can be investigated in education? Investigating in Education allows an exhaustive and objective analysis of the educational action. It allows a wide range of topics of interest (from individual research, such as case studies, to educational actions and interventions). Martínez (2007) points out some of the aspects that can be analyzed through the procedures of educational research are:

- Subject: student, teacher, educator, director, father, mother, etc.
- Method: teaching, learning, school management, coexistence, discipline, etc.
- Program: teacher, center, skills and competencies, educational policy, etc.
- Resource: teaching, technological, personal, economic, etc.
- Institution: centers and educational institutions, resource center for teachers.
- Environmental context: a classroom, an educational center or institution, etc.
- Effects: degree of satisfaction, degree of conflict, levels of academic achievement, degree of attainment, etc.

Research in Education allows us to know the characteristics and functioning of educational practice, as well as the relationships that exist between the elements.

Therefore, scientific research needs to be very comprehensive and objective, it is necessary to use a scientific method that facilitates a more accurate knowledge of educational reality, as far as possible by the very complexity of human and educational behaviors and processes (Martinez , 2007).

## Modalities of research

In this section we will mainly try to understand the characteristics of the types of investigations.

Research may adopt methods not contemplated in the initial design of research and may even invent new procedures; Thanks to this the advances in knowledge are allowed.

In any case we can say that the majority of the investigations could be classified in one of the following types:

1. Quantitative empirical-analytical research
2. Constructivist-qualitative research
3. Action research

We will briefly look at each approach below:

### 1. Quantitative empirical-analytical research

Following the model of scientific knowledge aims to formulate laws and objective explanations that govern the phenomena. There are critical sectors that question this methodology because they consider it reductionist because it is insufficient to explain the complexity of the educational reality.

### 2. Constructivist-qualitative research

According to this approach reality can only be studied using the points of view of the subjects involved in educational situations. It aims to obtain a direct knowledge of the educational reality, not filtered by previous schemes. For this it focuses on observing people in their natural context, interviewing them and analyzing their stories and documents, etc.

### 3. Action research

Some of the principles on which this type of research is based are:

The object of the investigation is the educational practice. Researchers are often professionals who "live" problems up close and the methodology is diverse depending on the needs and circumstances.

The reasons for undertaking this type of research are usually to solve problems and try to improve educational practice.

The types of research that may be part of the previous research modalities are detailed below:

#### a) Experimental research

Firstly, we will analyze the experimental studies, with these studies we intend to establish the relations between cause and effect of the variables, ie to identify the fact or factors that cause something to occur as a consequence of their action.

#### I. Characteristics of experimental research:

To do an experiment basically consists of performing some activity aimed at discovering, checking or demonstrating some fact.

In an experiment a variable (independent) of those involved is controlled by the researcher to see what effects it produces on the results (dependent variables). This control is what distinguishes the experimental methodology from other methodologies. It is important to keep the experiment under control in order to guarantee that the results are due precisely to the variations of the controlled variable. Every experiment usually uses two or more groups. On one of them is acted (experimental group), in the other group the behavior is observed without intervening in any way (control group).

It is imperative that the researcher can assure that the results obtained are due precisely to the manipulation he has made in the independent variable and not due to other causes (Buendía et al., 2003).

These studies should analyze how the behaviors or the results of certain interventions are produced and what are the underlying causes (see example table 2)

#### II. Features of quasi-experimental research:

In the quasi-experimental methodology the researcher also deliberately manipulated the levels of the independent variable (V.I.) to observe the effects that this manipulation produces on the dependent variable (V.D.). But it differs from it in that it does not exert the degree of control over the strange or intervening variables that characterize the experimental method. That is, the effects observed in the dependent variable (V.D.) may be due not only to the independent variable (V.I.) but also to other extraneous variables that are not controlled.

Although the quasi-experimental designs do not guarantee an internal and external validity level as the experimental ones, they offer a sufficient degree of validity, which makes its use in the field of education very viable.

There may also be differences with respect to sample choice: in the experimental method the sample is chosen randomly from the population, groups are randomly formed and their assignment to the different levels of the independent variable (VI) is also done random. In the quasi-experimental method, one or more of these requirements may be missing.

It can be stated that, in general, the quasi-experimental method is more indicated when the research is carried out in natural educational settings and the lack of a complete experimental control is accepted.

This method offers many advantages because of its proximity to educational reality, where it is often not possible to carry out experimental research, since it is not feasible to alter the structure or configuration of groups already formed, making it difficult to choose at random Subjects.

Next, we will observe the most common characteristics of the ex-post-facto method (Buendía et al., 2003).

### III. Characteristics of ex-post-facto research:

The main feature is that the researcher does not manipulate any variable to see what effects are produced.

The study is made when the fact or phenomenon has already happened, "ex-post-facto" means precisely "after the fact", "after having happened."

In order to study causal relationships (cause - effect), the experimental methodology offers more validity, but due to the complexity and the nature of social phenomena, it is not always possible to control all the necessary factors so that in many educational situations alone An ex-post-facto approach is feasible (Buendía et al., 2003).

#### b) Non-experimental research

According to most authors, three research methods can be distinguished (Buendía et al., 2003).

- a) Comparative-causal
- b) Descriptive
- c) Correlational

#### I. Comparative-causal studies:

Basically they consist of comparing the results obtained in a given learning by two groups, in principle homogeneous, that have followed different teaching procedures.

The objective is to provide evidence about which of the two methods is best considered (for more details see Table 3).

#### II. Descriptive studies:

These methods are intended to describe a phenomenon by analyzing it both in its overall structure and in its constituent parts using systematic observation.

If the data recorded are quantitative (numerical) in nature, large samples of subjects are usually used, while if they are of a non-quantifiable qualitative nature a small number of subjects are used. In practice it is common to combine both types of data

Descriptive studies can be classified into:

- 1) **Development studies** that study the changes that occur in subjects over time (for more information see table 4).
- 2) **Survey studies**, which describe situations.
- 3) **Case studies**, which study unit realities in detail.
- 4) **Observation studies**, which collect information from the direct observation of the subjects.

### 1) Development studies:

The researcher intends to describe the changes experienced by the variables over a given time.

Within these studies we distinguish "longitudinal", "transversal" and "cohort" studies.

- *Longitudinal studies*: the same characteristics of the same subjects are analyzed at different times or ages.
- *Cross-sectional studies*: at the same time different subjects are studied that are in different stages of development.
- *Cohort analysis*: changes in the behaviors of groups of subjects (cohorts) sharing one or several characteristics are investigated.

### 2) Survey studies:

A survey consists of a series of questions that are formulated directly to a representative sample of subjects by means of a previously elaborated script. The usual techniques of data collection are: the questionnaire and the interview (see table 5).

- Questionnaire.

All questionnaires must meet a number of requirements to be considered as having the necessary quality. The analysis of the data collected may incorporate methods of greater or lesser complexity depending on the intended purpose.

- The interview.

It usually consists of a conversation in which the interviewee answers questions; These may be open-ended or previously structured by the interviewer.

In the survey studies, the structured mode is preferably used. The quality of the interview depends fundamentally on:

- That a careful *planning* has been made in which the details of preparation and realization have been foreseen.
- The ability of the interviewer to *conduct* the interview so that they can meet what is planned or respond appropriately to any unforeseen events.
- The intellectual rigor of the *conclusions*.

### 3) Case study:

It is the study of a single subject, or a small group of subjects. It is a question of deepening in the study trying to extrapolate some conclusion applicable to the population to which the subject belongs, below we detail in more depth the study of cases:

The case study is presented as a methodology focused on the development of competences adapted to the proposed new curricula within the European Higher Education Area (Ruiz, Anguita, & Jorrín, 2006; Díez, Pacheco and García, 2010) .

The goal of the case study is to prepare students to acquire the skills required to make decisions in the dilemmas presented daily in their learning. Leadership and teamwork skills are exercised under the direction of an expert teacher who works with students to analyze, synthesize conflicting data and points of view; To define and prioritize goals; And, to persuade and inspire others to think differently, making decisions consistent with data obtained in a given research.

Its purpose is to examine the object from different positions, in order to discover why the object has acquired its present state.

- *There is no previous theoretical model*. The object of study differs from all previous objects and the purpose of the study is to describe its exceptional character.
- *The goal is to document the object as completely as possible*.
- *Phenomenological search for a deep understanding* and distrust in previous descriptions and explanations.

The case study as a methodology used to study an individual or an institution in a unique environment or situation and in a way as intense and detailed as possible, is an investigation that is defined as descriptive, that is, describes the situation prevailing at the time Of the study.

#### **Advantages of the case study method**

- They focus on a single individual or thing (eg, a person or school district), allowing for a very thorough review and compilation of a large amount of detailed data.
- They encourage the use of several different techniques to obtain the necessary information, ranging from personal observations to interviews.
- They do not test hypotheses, suggest directions for further studies.
- They reveal a diversity and wealth of human behavior that simply is not accessible by any other method.

#### **Characteristics of the case study**

- Cases must pose a real situation. The cases are examples of concrete aspects of the practice, supplemented with information about the context, thoughts, feelings and actions.
- The description of the case must come from the contact with real life and from the concrete and personal experience of the teacher.
- It must be clear and understandable.
- You should not suggest solutions.
- It should be open to different interpretations.
- It should facilitate student participation and critical thinking.
- The main and secondary aspects of the information must be intertwined.
- The time for discussion and decision-making should be limited.
- The description of problematic situations must be based on a theoretical foundation.
- The case study should seek to achieve educational objectives concerning both knowledge, attitudes and specific skills.

#### **4) Observation studies:**

Developing an observant attitude and acquiring skill in the use of observation techniques is an indispensable instrument not only for research but also to be a professional of Education, especially in Early Childhood Education and first cycle of Primary.

##### *Types of observation*

The investigator may participate as a member of the investigated group "participant observation" or may perform "non-participant or external observation" in which case the observer tries to stay out of the subjects and events studied (for more details see table 6).

We can establish the following four phases (García, Pacheco, Díez and García-Martín, 2010):

#### **Specification of the problem**

More decisive phase; It is necessary a preliminary observation that will be the source of questions that are intended to answer.

It is important to specify mechanisms to minimize the distortions produced by the observer's subjectivism.

## Data Collection

The four most important data record types are: anecdotal record, checklist, rating scales, and category system.

## Analysis of this data

The analysis of the data should allow to extract from them as much information as possible, depending on the objectives and the type of measure used.

Four types of analysis elements can be established:

- Frequency of behavior
- Order of appearance
- Duration
- Intensity

## Interpretation of data and conclusions

### III. Correlational studies:

It is said that between two variables there is correlation when the behavior of one of them varies in the same direction as the one of the other; ie when one variable increases the other variable also does or vice versa.

A high correlation does not imply causality; It can be mere chance.

- Correlation consists of a statistical description of the relationship between two variables.
- It is expressed by a number and a sign.
- The correlations range from 1.00 to -1.00, the closer it approaches 1 or -1 the stronger the relationship.
  - Positive correlation indicates that the two variables increase or decrease in the same direction (positive sign). Ex. The more motivation a student has, the greater their performance and the lower the self-esteem, the lower their performance.
  - Negative correlation, implies that the increase of one variable implies the decrease of another (negative sign). Eg, greater teacher experience, less anxiety in class, and less experience, more anxiety in class.
  - A correlation is null when there is no relationship between two variables. Eg There is no relationship between height and eye color or between weight and number of languages spoken.

In addition to the studies analyzed so far, we also highlight bibliographic or revision studies that are part of a different proportion of all studies:

### C) Other research studies:

#### I. Bibliographic studies

Bibliographic research is characterized by the use of bibliographic data as a source of information.

It seeks to find solutions to problems posed by a double track:

- a) Relating existing data from different sources.
- b) Providing a panoramic and systematic view of a given issue elaborated in multiple scattered sources.

One of the main advantages of a bibliographic design is that it covers a wide range of phenomena, since it encompasses a much more extensive spatio-temporal reality.

One possible drawback is the quality of bibliographic sources. To alleviate this difficulty the researcher must ensure:



- The specific conditions in which the data were obtained.
- The absence of inconsistencies or contradictions.
- Use several different sources by carefully matching them.

In summary, the bibliographic research consists of the *search, compilation, organization, valuation, criticism and information of bibliographic data*.

## II. Action research studies

Action research aims at improving the teaching practice by implementing the programs or actions that constitute its objectives.

According to Herbert, Kemmis, McTaggart, and Zuber-Skerritt, (2002), action research is defined as a form of collective self-reflexive research undertaken by participants in social situations to improve productivity, rationality and justice of their own social practices Or educational, as well as their understanding of such practices and the situations in which they occur.

It must be taken into account that action research is a collective and collaborative research. The personal reflection accompanied by the reflexive, improves the teaching practice.

### CONCLUSIONS

We can consider the scientific method as a set of universal and necessary thoughts, constituted by universal laws that form a systematic knowledge of reality. In the process of scientific research various methods and techniques are used according to the particular science of origin and according to the specific characteristics of the object of study.

For this reason, an adequate elaboration of those universal and necessary thoughts is sought. In the process of scientific research various methods and techniques are used according to the particular science involved and according to the specific characteristics of the object of study.

Research methods are applied according to the objectives designed to achieve a specific purpose. Although we must not forget that all research must be accompanied by an exhaustive bibliographical review.

## Bibliografía

- Buendía, L., Colás, P. y Hernández, F. (2003). *Métodos de investigación en Psicopedagogía*. Madrid: McGrawHill
- Castillo, S. (2002). *Compromisos de la Evaluación Educativa*. Madrid: PrenticeHall.
- Díez, M. C., García, J. N., Robledo, P., & Pacheco, D. I. (2009). Habilidades sociales y composición escrita en alumnos con dificultades de aprendizaje y/o bajo rendimiento. *Boletín de Psicología*, 95, 73-86.
- Díez, M.C., Pacheco-Sanz, D.I., & García, J. N. (2010). *Procesos de inclusión en alumnos con dificultades de aprendizaje (DA) a través del estudio de casos (EC)*. II Congreso Internacional de Convivencia Escolar, Cd 16-19 de Marzo de 2010. Almería (España).
- Herbert A., Kemmis, E., McTaggart, R, y Zuber-Skerritt, O. (2002) . The concept of action research. *Learning Organization*, 9 (3), pp.125 – 131.
- García, J. N., Pacheco, D I., Díez, M. C., & García-Martín, E. (2010). La metodología observacional como desarrollo de competencias en el aprendizaje. (INFAD). *Internacional Journal of Developmental and Educational Psychology, Revista de Psicología, Psicología Positiva: educación y discapacidad: Siglo XXII*, 1, (3), 211-217.
- *Guía Rápida del Manual de Publicaciones de la APA (2011)*. 6ª Ed. Recuperado de <http://homepage.mac.com/penagoscorzo/apa/index.html>
- Ley Orgánica 8/2013, de 9 de diciembre, para la mejora de la calidad educativa (LOMCE)
- Martínez, R.A. (2007). *La investigación en la práctica educativa: guía metodológica de investigación para el diagnóstico y evaluación en los centros docentes*. Madrid: CIDE.
- Ramos, J. L. (2010). Ejemplos de diseños de investigación. (Documento didáctico).
- Ruiz, R. (2007). *El método científico y sus etapas*. (Documento didáctico).
- Spencer Johnson, M.D. (2000). *¿Quién se ha llevado mi queso?*. Barcelona: Urano.